

An anatomical illustration of the human digestive system. The liver is shown in red on the left, and the stomach is in pink on the right. The large intestine is depicted in blue at the bottom. The entire system is overlaid with a colorful, glowing representation of a microbiome, consisting of various shapes like spheres, spirals, and clusters in colors such as red, green, yellow, and blue. The text "How healthy is your gut microbiome?" is centered over the stomach and large intestine area.

How healthy is your gut microbiome?

Could the bloating or discomfort you feel
after eating or drinking ...

be a sign that something in your
intestinal tract is amiss?

We compiled the top 15 questions people have

about what's going on inside their guts.

Then we turned to some of the leading experts in nutrition and gastroenterology for answers.

The Wild World Inside Your Gut

By Alice Callahan Illustration by Alex Kiesling

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We tackled everything from heartburn, stress, spicy foods and colon cleanses to antibiotics and more. So grab a kombucha, get comfortable and read on for everything you've wanted to know about the wild world inside your gut.

COLLAPSE ALL

1 How can I tell if my gut is healthy? And what are some warning signs that it isn't?

The simplest sign of a smoothly running gastrointestinal tract is also the most boring one: Your gut should chug along quietly and with little complaint. Eating or drinking should not cause more than occasional bloating or discomfort, and you should have regular, well-formed bowel movements every one to three days that pass without much straining, said Dr. Folasade May, a gastroenterologist and associate professor of medicine at the David Geffen School of Medicine at U.C.L.A.

If you regularly have discomfort or pain from symptoms like acid reflux, bloating, constipation or diarrhea, that could be a sign that your gut is not working optimally, Dr. May said. And

it may be worth thinking about whether simple tweaks to your diet and other lifestyle factors would help. (More on this below.)

If your symptoms persist or affect your quality of life, you should see a primary care provider or a gastroenterologist, Dr. May said. And seek care right away if you have what she called “red flag” symptoms such as nausea and vomiting, recurrent abdominal pain, infrequent or painful stools, or blood in your stool — these symptoms could indicate a serious condition, like an infection, inflammatory bowel disease or even cancer.

2 **How does my gut affect the rest of my body?**

Aside from your gut’s obvious job of digesting food and absorbing nutrients, research has shown that the trillions of bacteria, viruses and fungi that inhabit your intestinal tract (also known as the gut microbiome) can “influence virtually all aspects of our biology,” said Justin Sonnenburg, a professor of microbiology and immunology at Stanford Medicine.

Much of your immune system resides in your gut, for example, and its resident microbes influence how that system functions, he said. And your gut microbes produce a variety of small molecules that have been shown to affect metabolism, inflammation and appetite, with possible links to certain diseases including obesity, heart disease and even some types of cancer.

“The gut also influences what’s happening in the brain,” said Dr. William Chey, a professor of gastroenterology and nutritional sciences at Michigan Medicine. One study published in 2016, for example, found that transferring gut

microbes from humans with depression into rats induced depressive and anxious behaviors in the rodents. Some human studies have also shown that taking certain gut bacteria as probiotic supplements may improve anxiety and depression, but it's too early to recommend probiotics to improve mental health, Dr. Chey said.

3 **What are some simple things I can do to improve my gut health?**

Unsurprisingly, the best way to care for your gut is to feed yourself — and by extension, your gut microbes — well.

Prioritizing foods rich in fiber (such as vegetables, whole grains, nuts, seeds, beans and lentils) is one main way to boost gut health because fiber is an important source of nutrients for those bacteria, said Emily Haller, a registered dietitian nutritionist at Michigan Medicine.

Consuming a variety of plant-based foods can also help to diversify the types of microbes in your gut, which is associated with better health, Ms. Haller said. One study published in 2018, for instance, found that people who ate more than 30 types of plant foods per week had a more diverse gut microbiome than those who ate up to 10 types of plant foods per week.

Adding more fermented foods like yogurt, kefir, kombucha, sauerkraut or kimchi to your diet can also be a safe (and tasty) way to boost the diversity of your microbiome and decrease inflammation, Dr. Sonnenburg said. Though more research is needed to confirm those links and to determine how much fermented food you must eat to obtain those benefits.

4 **Are there any foods I should limit for the sake of my gut health?**

Generally speaking, highly processed foods tend to contain little fiber for gut microbes to eat. Some processed foods also contain certain synthetic emulsifiers (added to improve texture and shelf life) that have been shown in mice and limited human studies to harm the gut by reducing the diversity of the gut microbiome, degrading the gut lining and increasing inflammation, said Jens Walter, a professor of ecology, food and the microbiome at University College Cork in Ireland.

Alcohol as well as processed and red meats has also been associated with greater risk of colorectal cancer, so it's best to limit them, health experts say. But don't stress about the occasional hot dog or beer, Ms. Haller said. What's more important is to make sure that what you eat overall, "for days and weeks and years," contains more whole plant foods and less processed foods. That "really is going to have the strongest impact on our health, including gut health," she said.

5 **I often feel heartburn after I eat. Why is that and what can I do to stop it?**

When the sphincter muscle that connects the bottom of your esophagus to your stomach opens more than it should and allows too much stomach acid to enter, or if acid from your stomach lingers in your esophagus for too long, that can cause

heartburn or other symptoms of acid reflux, said Dr. Rena Yadlapati, a gastroenterologist and associate professor of clinical medicine at the University of California, San Diego. Some people have more sensitive nerve endings in their esophagus, so they sense burning and pain even in response to a normal amount of acid, especially when they are stressed or anxious. “There are so many nerve endings in the esophagus, and those are closely related to the brain,” Dr. Yadlapati said. “And so during times of stress, anxiety, hormonal changes or in some people just at baseline,” she said, those feelings can be “incredibly heightened.”

Wearing loose clothing during and after meals, reducing the size of your portions, chewing gum after eating and waiting three hours between eating and reclining or lying down can all help with reflux symptoms, Dr. Yadlapati said, as can quitting smoking (if you smoke) and maintaining a healthy weight. You can also limit irritating foods and drinks — common ones include coffee, alcohol, chocolate, tomatoes or spicy or greasy foods — though everyone’s triggers are different, she said.

Over-the-counter medications such as antacids (Rolaids, Tums), histamine-2 blockers (Pepcid, Tagamet HB) and proton pump inhibitors (Prilosec, Nexium) can help manage reflux symptoms, Dr. Chey said. Check with your doctor about what medications are best for you.

Dr. Yadlapati also added that diaphragmatic breathing, deep breathing exercises that emphasize filling the belly, can help. It “not only strengthens the diaphragm, which has been shown to reduce reflux events, but is also a wonderful relaxation strategy,” she said. Patients whose symptoms worsen with stress may also benefit from seeing a therapist who specializes

in gut health and who uses techniques like cognitive behavioral therapy and hypnotherapy to reduce acid reflux symptoms.

6 **Am I at risk for an ulcer if I am constantly stressed and eat a lot of spicy food?**

In short: No, Dr. Chey said.

Peptic ulcers occur when open sores form in the stomach's protective lining or in the beginning of the small intestine. They are caused by either infection with the *Helicobacter pylori* bacteria or the use of nonsteroidal anti-inflammatory drugs (or NSAIDs) such as aspirin, ibuprofen and naproxen, especially when taken at higher doses or for long periods of time, though individual sensitivities can vary. Over time, both *H. pylori* and NSAIDs can break down the mucosal barrier of the gut lining, eventually causing an ulcer to develop.

Ulcers caused by *H. pylori* infections are treated with antibiotics, and those caused by NSAIDs are treated by stopping their use. (If you need over-the-counter pain medication in the interim, your doctor may recommend an alternative such as acetaminophen.) Proton pump inhibitor medications that reduce the secretion of stomach acid (like Prilosec) are also prescribed in the short term to allow ulcers to heal, or for the long term if you need to take NSAIDs regularly.

7 **What is 'leaky gut syndrome' and how do I know if I have it?**

You'll find plenty of online articles claiming that something called "leaky gut syndrome" can cause asthma, arthritis,

Alzheimer's disease and more, and that specific diets or supplements can cure it. While it's true that a leaky intestinal lining can be associated with some medical conditions, Dr. Chey said, the syndrome is not recognized as a medical diagnosis. And claims that it causes numerous diseases or that supplements can fix the problem, he added, are not backed by science.

Leaky gut syndrome is based on the idea that a more permeable intestinal lining allows toxic substances and other undesirable molecules into the body, but there isn't a well-validated clinical test for it, Dr. Chey said. That said, researchers have ways to measure the permeability of the gut lining and are investigating how it might be linked with conditions like irritable bowel syndrome, inflammatory bowel disease and celiac disease.

Experts are just beginning to understand the relationship between intestinal permeability and disease, though, Dr. Chey said. And the supplements on the market have not been well studied to see if they can correct leaky gut or if they are safe, he added.

Dr. Walter agreed: "It's really the high-fiber, low-processed foods and avoidance of certain ingredients such as emulsifiers that would improve your barrier."

8 **Can refined carbs like sugar or white flour cause an overgrowth of yeast in my gut?**

Some functional medical providers claim that eating too much sugar or other refined carbohydrates can cause an overgrowth of fungus, particularly Candida yeast, in the gut, causing symptoms like intestinal discomfort, skin rashes and fatigue.

The problem, they say, can be treated with things like restrictive diets, cleanses, supplements or essential oils.

While it's true that an overgrowth of yeast and other types of fungus in the body can cause issues like yeast infections or thrush, there's currently no evidence that eating sugar or other refined carbohydrates can cause too much yeast to grow in your GI tract, said Dr. Satish Rao, a gastroenterologist and professor of medicine at Augusta University in Georgia. (Though for general gut health, Dr. Rao said, most people living in the United States could benefit from eating fewer refined carbohydrates and more fiber.)

Dr. Rao said that it is possible for fungus to overgrow in the small intestine — often in people who have taken antibiotics or steroid medications, are immunocompromised, have diabetes or have issues like motility disorders that result in slower movement of food through the GI tract. He treats such patients with oral antifungal medications. But how common this condition is — as well as how to diagnose and treat it — is controversial among gastroenterologists, and many don't test for it, he acknowledged. The role of yeast and other fungus in GI health is an area that needs far more research, he said.

9 **Are antibiotics bad for my gut health? And if so, what can I do to prevent the damage?**

In the process of wiping out harmful bacteria, antibiotics can kill 90 to 99 percent of the beneficial microbes in your gut, Dr. Sonnenburg said: “It’s like carpet bombing this ecosystem.”

After an average course of antibiotics, your gut microbes

should recover over the following weeks and months, he said. But in the meantime, you are more vulnerable to certain, potentially serious, infections.

Experts don't know much about how your diet can influence the recovery of your gut microbes after a course of antibiotics, but Dr. Sonnenburg suggested focusing on this familiar advice: Eat high-fiber, plant-based and fermented foods.

As for whether probiotic supplements can help, the jury is still out, Dr. Sonnenburg said. That's in part because many of the studies done have tested different types of antibiotics and probiotics, and their results have been inconsistent, he said. One detailed study published in the journal *Cell* in 2018 found that taking probiotics actually delayed the regrowth of the microbiome.

10 **I've seen a lot of ads for colon cleanses. What are they and should I do one?**

Whether you're flushing waste from your colon via a tube inserted into your rectum, or taking supplements that contain laxatives, fiber or other ingredients, there's no reason to do a colon cleanse unless your doctor recommends it, Dr. May said.

Some alternative medical providers may claim that colon cleanses can flush out toxins, boost energy, strengthen your immune system and help you lose weight. But your body is already equipped with effective systems for managing waste and toxins via your kidneys, liver and intestinal tract, she said, and any weight you may lose from a colon cleanse will be temporary.

Colon cleanses can also come with some risks, Dr. May added.

Frequent colon cleansing via irrigation or laxative use can disrupt the coordinated muscular contractions that move stool through the colon, sometimes leading to issues with constipation, she said. And in general, supplements aren't tightly regulated for safety and effectiveness.

Dr. May particularly cautioned against procedures that involve flushing fluids through the colon, whether done at home or in an alternative medical clinic. "These can be very dangerous" because of the risk of perforation of the colon or an infection introduced by unclean equipment, she said. Coffee enemas in particular have caused severe inflammation of the rectum and colon and even death.

11 **So what should I do to take care of my colon?**

Following a healthy diet rich in fruits and vegetables and with limited amounts of processed, sugary and fried foods, drinking enough fluids and staying active can all keep your colon running smoothly, Dr. May said. An extensive review article published in 2021 in the journal JAMA Network Open, for instance, concluded that consuming more dietary fiber, less red meat and little alcohol was associated with a lower risk of colorectal cancer, which was the second leading cause of cancer deaths in the United States in 2020.

Experts also recommend that most adults should start screening for colon cancer at age 45 (or 40 if you have a family history), Dr. May said. Colonoscopy is the most common screening method, but other tests are also available, including noninvasive stool tests. "There are many ways to get screened," Dr. May said, "and everyone needs to do it."

12 **What can the shape, type and frequency of my stool tell me about my health?**

If your stool looks like something in the range of a smooth snake or a sausage with a cracked surface, that is considered healthy, Dr. May said. “The analogy I use is toothpaste, like squeezing toothpaste out of a tube. That’s what your stool should look like,” she added.

If your stool looks more like small, separate pieces or pellets, or resembles lumpy sausage shapes, that could indicate constipation, she said. And if you have loose stools that look like soft blobs, ragged pieces or watery liquid, that signals diarrhea. Occasional diarrhea is common, but if it’s ongoing then it’s worth seeing your doctor to rule out a possible infection, food intolerance or a condition like celiac disease or irritable bowel syndrome.

Frequency is less important than stool appearance, Dr. May said. “A lot of people are obsessed with the concept of having a bowel movement every day, and it does not have to be every day.” It can be normal to go three times per week or three times per day, she said.

13 **If I see identifiable foods in my stool, does that mean I have a food intolerance?**

Spotting an intact food in your poop doesn’t mean you’re intolerant to it, Ms. Haller said. It just means that the food wasn’t completely broken down by your intestines, usually

because the food had a tough exterior or you simply didn't chew it well enough.

“Almost everybody has seen some corn hanging out in the toilet bowl at some point,” Ms. Haller said, but this is normal.

There are some cases, however, where intact foods in your poop can signal a problem. Certain GI conditions like irritable bowel syndrome or inflammatory bowel disease can cause inflammation or fast transit of food through the gut, which can interfere with normal digestion. If you're noticing more intact foods in your poop, particularly if it is accompanied by other symptoms or changes to your bowel habits, check with your doctor, Ms. Haller said.

14 **What actually works to prevent constipation?**

As with most things related to the gut, following a healthy, fiber-rich diet can help. And if you're not exercising regularly and drinking enough water, increasing your physical activity and fluid intake can reduce constipation issues, Dr. Chey said. Some studies have also shown that eating prunes or kiwis can alleviate chronic constipation. Psyllium fiber supplements can also be taken daily if needed — just be sure to drink plenty of water with them, he said.

Eating breakfast, Ms. Haller added, as well as drinking coffee can often help maintain regular bowel movements. She also recommended using a Squatty Potty or other toilet stool to improve your posture on the toilet. By bringing your knees above your hips, “it's putting your body in a more optimal position to have a complete bowel movement,” she said.

Poor coordination or weakness of the pelvic floor muscles can

also contribute to constipation. If this is the case, pelvic floor physical therapy has been shown to help.

15 **If I use over-the-counter laxatives, will my gut build up a tolerance or become dependent on them?**

Effective over-the-counter laxatives like polyethylene glycol (Miralax), magnesium oxide supplements and stimulant laxatives containing senna or bisacodyl can help address chronic constipation, Dr. Chey said.

There's some concern that regular, long-term use of such stimulant laxatives can cause your colon to lose its normal activity, leading to a dependence. These laxatives appear to be safe, but have only been studied in trials lasting about four weeks, Dr. Chey said, so for now, he recommends stimulant laxatives just for occasional or short-term use.

There's more data supporting the safety of prolonged daily use of polyethylene glycol (Miralax), though.

If you find that you're regularly relying on laxatives to have bowel movements, talk to a health care provider about other approaches for managing your constipation. Highly effective prescription medications for chronic constipation like lubiprostone, linaclotide, plecanatide and prucalopride are also available, Dr. Chey said. "It's a cool time for constipated patients, because there are a lot of options."